GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[x] ORIGINAL [ ] REVISION NO. _____

Project No. A-3780 GTRI/~~GIT~~ DATE 4 / 5 / 84

Project Director: J. K. Daher ~~School~~/Lab ECSL-ECD

Sponsor: Federal Express; Memphis, TN 38194

Type Agreement: Purchase Order No. 17446

Award Period: From 3/1/84 To 5/31/84 (Performance) 5/31/84 (Reports)

Sponsor Amount:	This Change	Total to Date
Estimated: $		$ 8,384
Funded: $		$ 8,384

Cost Sharing Amount: $ _____ Cost Sharing No: _____

Title: Field Survey Measurements

ADMINISTRATIVE DATA OCA Contact John W. Burdette x4820

1) Sponsor Technical Contact:

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Memphis, TN 38194-1831

2) Sponsor Admin/Contractual Matters:

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Defense Priority Rating: n/a Military Security Classification: n/a

(or) Company/Industrial Proprietary: n/a

RESTRICTIONS

See Attached ---- Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval – Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with none proposed

COMMENTS:

Sponsor I.D. Number 01.205.000.84.005

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FORM OCA 4:383

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 10/22/84

Project No. A-3780 ~~School~~/Lab ECSL

Includes Subproject No.(s) N/A

Project Director(s) J.K. Daher GTRI / ~~GIT~~

Sponsor Federal Express Memphis, TN 38194

Title Field Survey Measurements

Effective Completion Date: 7/31/84 (Performance) 7/31/84 (Reports)

Grant/Contract Closeout Actions Remaining:

- [ ] None
- [x] Final Invoice or Final Fiscal Report
- [ ] Closing Documents
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

Continues Project No. Continued by Project No.

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M. Heyser

Georgia Institute of Technology
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23 July 1984

Federal Express
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4001 Airways/Properties Trailer
Memphis, TN 38194-1831

Attention: Mr. Bob Puckett

SUBJECT: Final Letter Report, "Field Survey Measurements"
Project A-3780

This letter report describes the activities and summarizes the findings and conclusions of a measurement program recently undertaken by Georgia Tech for the Federal Express Corporation. The objective of the program was to determine the electric field intensity levels at various locations within the new Federal Express computer building, Module "I," and to recommend and verify means of reducing these field intensities to acceptable levels.

The program began with an initial verification of the baseline field intensity data as measured previously by IBM Corporation personnel. The source of potential interference to IBM computer equipment is a one megawatt airport surveillance radar located approximately 1.6 miles from the building. Tests were performed at the same locations as previous tests made by IBM, i.e., along the south wall for all three floors of Module "I." The peak electric field intensity (E) was measured using a standard gain horn antenna to receive and a calibrated crystal diode/oscilloscope to detect peak received signal levels.

The measurement results are tabulated in the first column of data in Table 1. For reference, a description of the measurement positions is given in Table 2, and a photograph of a typical detected waveform is shown in Figure 1. The peak field intensities were consistently highest on the third floor with decreasing levels obtained for the second and first floors, respectively. In general, the measured levels were approximately 4 to 5 dB below those measured by IBM. Two primary observations were made from the initial data set. First, the field intensities measured with the antenna close to or touching the wall were more than 20 dB below those in which the receive antenna was oriented with a direct line-of-sight to the radar through a window. This indicated that the majority of the leakage into the building was through the windows. Secondly, placing a screen over the window in the line-of-sight between the radar and the receive antenna (the screen experiment in Table 1) reduced the peak field intensity on the order of 12 dB. Since IBM personnel set a 6 to 12 dB reduction as a goal, it was tentatively concluded that placing aluminum screens in the windows would provide the necessary attenuation.

After permanent screens were installed, another set of measurements was performed to verify the effectiveness of the screens in providing electromagnetic shielding. The results of these final measurements are shown in the second column of data in Table 1. As a means for evaluating the effectiveness of the screens, the difference in dB between the initial and final field intensity readings is also tabulated for each common measurement position. The average reduction in peak field intensity due to the screens was 16.8 dB or a reduction ratio of 6.9:1. Thus, the original goal of a 6 to 12 dB reduction was exceeded and satisfactory operation of the computer and peripheral equipment is expected.

During the second set of measurements, additional data were taken near the back wall (positions 11, 12, and 13 of Tables 1 and 2); from these and other spot measurements it was determined that some leakage was occurring through the third floor sun screen windows near the ceiling on the south wall. It is therefore recommended that aluminum screening be used to cover these windows also, and that additional measurements be made to ensure that the aperture is closed sufficiently.

If I can be of help in this or any additional matter, please feel free to contact me. It has been a pleasure to work with you and I look forward to any future associations we might have.

Sincerely,

John K. Daher
Research Engineer

JKD/ddm

Attachments

TABLE 1. Measured Electric Field Intensity Data Before and After Permanent Screens Were Installed

POSITION NUMBER[1]	INITIAL READINGS (IN V/M) WITHOUT SCREENS	INITIAL READINGS (IN V/M) SCREEN EXPERIMENT[2]	FINAL READINGS (IN V/M) WITH PERMANENT SCREENS	CHANGE IN LEVEL (dB)
1	13.3	3.5	1.1	-21.6
2	23.1	5.2	2.5	-19.3
3	16.8	-	7.8	- 6.7
4	21.9	-	2.4[3]	-19.2
5	1.7	-	1.7	0.0[4]
6	6.3	-	0.7	-19.1
7	4.7	-	0.7	-16.5
8	7.0	1.1	1.2	-15.3
9	2.5	-	-	-
10	3.0	-	-	-
11	-	-	3.6	-
12	-	-	4.6	-
13	-	-	7.0	-

NOTES:
1. See Table 2 for a description of measurement positions.
2. Aluminum screen was temporarily taped over the window blocking the line-of-sight between radar and receive antenna.
3. Position for final reading was the same as for initial reading except antenna was placed one inch behind screen.
4. No change in level was expected since receive antenna was located on the floor, touching the wall under the window and the impact of the screen is negligible under these conditions.

TABLE II. Description of Measurement Positions

POSITION NO.	FLOOR	ROOM	POINT OF REFERENCE	EXACT ANTENNA LOCATION
1	3	DASD	2nd group of windows from east end, center window, lower pane	4' from window, 3' above floor
2	3	DASD	2nd group of windows from east end, center window, lower pane	4' from wall, 3' above floor, line-of-sight to radar through center window
3	3	DASD	2nd group of windows from east end, center window, lower pane	Touching 3rd window from left, upper pane
4	3	DASD	2nd group of windows from east end, center window, lower pane	Touching center window, lower pane
5	3	DASD	2nd group of windows from east end, center window, lower pane	Touching wall, under window, on floor
6	2	Processor Room	Large floor to ceiling window adjacent to processor 3082#I	Touching window at floor level
7	2	Processor Room	Large floor to ceiling window adjacent to processor 3082#I	Touching window 6' above floor
8	2	Processor Room	Large floor to ceiling window adjacent to processor 3082#I	At 3082#I, 10' from window, 3' above floor
9	1	Tape Drive Room	Fourth window from east end of room	On window ledge, touching window
10	1	Tape Drive Room	North interior wall	6' above floor, line-of-sight through 4th window
11	3	DASD	Along back (north) wall at edge of door by temperature plotter	5'6" above floor, 7' from back wall
12	3	DASD	Along back (north) wall at edge of door by temperature plotter	3' above floor, 14' from back wall, pointed at IBM 3380 (S/N 21980)
13	3	DASD	Along back (north) wall, 6' from east wall	5' above floor, 14' from back wall, line-of-sight to radar

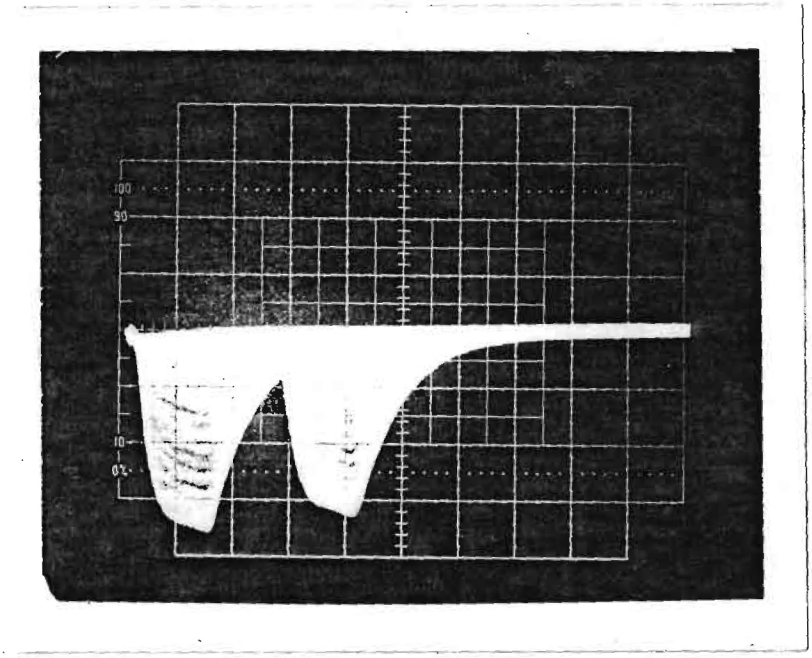

Figure 1. Photograph of a Typical Detected Waveform (20 mV/div, 0.5 μs/div)